L 00560-66 EWT(1)/FCC/EWA(h) GW

ACCESSION NR: AP5021006

UR/0203/65/005/004/0762/0766
550.388.2:621.391.81

AUTHORS: Gringauz, K. I.; Kravtsov, Yu. A.; Rudakov, V. A.; Rytov, S. M. 49 48 B

TITLE: On the possibility of determining local electron concentrations using the dispersion method with the help of artificial satellites and on a new ionization maximum in the ionosphere

SOURCE: Geomagnetizm i aeronomiya, v. 5, no. 4, 1965, 762-766

TOPIC TAGS: electron concentration, ionization, artificial satellite, ionosphere, Doppler shift, F layer 17

ABSTRACT: In order to determine whether dispersion methods for measuring N_o in the ionosphere by means of artificial satellites are valid, the various gradient terms $\partial N/\partial x$, $\partial N/\partial y$, and $\partial N/\partial t$ must be investigated to determine if they are significant in comparison with N_o. These various gradient terms that appear in the expression for the difference in Doppler shift between frequencies ω_1 and ω_2 are given by

$$[N_R]=\frac{1}{z_0}\int_0^{z_0} N dz,\quad \left[\frac{\partial N}{\partial x}\right]=\frac{1}{z_0\cos\varphi_0\sin\varphi_0}\int_0^{z_0}\frac{\partial N}{\partial x}z dz\quad \left[\frac{\partial N}{\partial y}\right]=\frac{1}{z_0\cos\varphi_0}\int_0^{z_0}\frac{\partial N}{\partial y}z dz.$$

Card 1/3

L 5277-66
ACCESSION NR: AT5023624

ENCLOSURE: 03

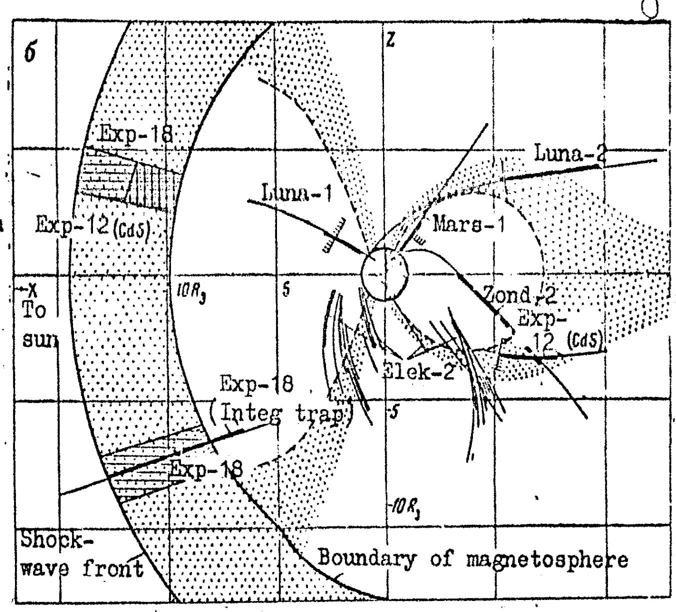


Fig. 3. Charged-particle distribution in projection on meridian plane in solar-elliptical coordinate system

6C

Card 5/5

L 5277-66

ACCESSION NR: AT5023624

ENCLOSURE: 02

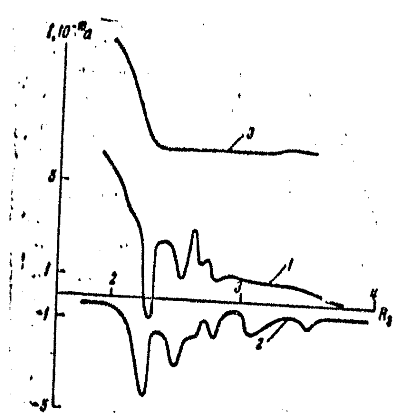


Fig. 2. Collector currents of integral traps and hard-radiation count rate (Mars-1). 1- suppressor grid potential $\varphi = 0$; 2- $\varphi = 50$ V; 3- count rate in relative units

Card 4/5

L 5277-66
ACCESSION NR: AT5023624 ENCLOSURE: 01

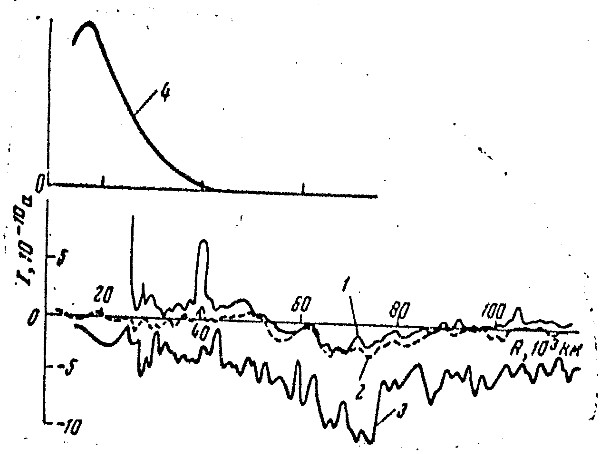


Fig. 1. Collector currents of integral traps and hard-radiation count rate. 1- upper boundary of collector currents with suppressor grid potential φ = -10, -5, and 0 V; 2- lower boundary of same currents; 3- upper boundary with φ = 15 V; 4- count rate in relative units

Card 3/5

L 5277-66
ACCESSION NR: AT5023624

recordings for Márs-1 (high geomagnetic latitudes) are given in Fig. 2 on the Enclosure. It is found that the relationship between the day and night regions of the radiation belt is probably a function of the structure of the geomagnetic field. The data from Elektron-2 indicate the presence of a relationship between the intensity of the soft-electron fluxes, the orientation of the axis of the geomagnetic dipole, and the geomagnetic activity. Orig. art. has: 7 graphs, 3 diagrams, and 1 table.

ASSOCIATION: Vsesoyuznaya konferentsiya po fizike kosmicheskogo prostranstva, Moscow (All-Union Conference on Space Physics)

SUBMITTED: 02Sep65 ENCL: 03 SUB CODE: ES, NP

NO REF SOV: 016 OTHER: 038

Card 2/5

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

L 5277-66 FSS-2/EWT(l)/FS(s)/EWT(m)/FS(v)-3/FCC/EWA(d)/EWA(h) TT/GS/GW
ACCESSION NR: AT5023624 UR/0000/65/000/000/0467/0482
81

AUTHORS: Gringauz, K. I.; Khokhlov, M. Z.

TITLE: The outermost Van Allen belt of charged particles

SOURCE: Vsesoyuznaya konferentsiya po fizike kosmicheskogo prostranstva. Moscow, 1965. Issledovaniya kosmicheskogo prostranstva (Space research); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 467-482

TOPIC TAGS: radiation belt, electron flux, proton, electron energy, radiation intensity, proton counter, geomagnetic field, rocket, satellite, space probe, radiation detector 19

ABSTRACT: The results of a study of the zone of particles with energies from ~100 eV to 40 keV beyond the outer Van Allen belt are examined. The work was done in an attempt to find a key to solving some of the most important problems of space research. Data on the fluxes of soft electrons and protons recorded by the following satellites and rockets were used: Luna-1, Luna-2, Explorer-12, Mars-1, Explorer-18, Elektron-2, and Zond-2. Examples of recordings of integral-trap collector currents for Luna-2 (observations at low geomagnetic latitudes) are given in Fig. 1 on the Enclosure, which also gives the hard-radiation count rate. Similar

0901 0513

L 2993-66
ACCESSION NR: AT5023612

6

recorded on 31 January 1964. Experimental data for this period indicate that this flux is at least ten times the intensity of high-energy electrons trapped in the outer radiation belt and recorded constantly by the radiation counter. These results may be interpreted as evidence of a soft component in the electron fluxes of the outer radiation belt that varies with time to a much greater extent than does the high-energy particle flux. The soft electron region always extended beyond the outer boundary of the radiation belt. "The authors are grateful to S. N. Vernov, Yu. N. Logachev, E. N. Sosnovets, Ye. A. Benediktov, G. G. Getmantsev, and N. A. Mityakov who kindly allowed us to study the results of their experiments before publication." Orig. art. has: 3 figures. [14]

ASSOCIATION: none

SUBMITTED: 02Sep65 ENCL: 00 SUB CODE: ES, NP

NO REF SOV: 004 OTHER: 000 ATD PRESS: 4110

Card 2/2 hd

L 2393-66 FSS-2/EWT(1)/FS(v)-3/FCC/EWA(d)/EWA(h) TT/GS/GW

ACCESSION NR: AT5023612 UR/0000/65/000/000/0418/0419

AUTHOR: Bezrukikh, V. V.; Gringauz, K. I.; Musatov, L. S.; Solomatina, E. K.

TITLE: Possibility of a soft electron component in the outer radiation belt, and the variations in this component

SOURCE: Vsesoyuznaya konferentsiya po fizike kosmicheskogo prostranstva. Moscow, 1965. Issledovaniya kosmicheskogo prostranstva (Space research); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 418-419

TOPIC TAGS: satellite data analysis, radiation belt, electron radiation

ABSTRACT: Data are given from measurements of charged particle fluxes made by the "Elektron-2" satellite using charged particle traps. The data were obtained during passage of the satellite through the outer radiation belt in the initial stage of flight. Negative collector currents recorded in the trap varied considerably from orbit to orbit; on some orbits there were practically no negative currents. At the same time, radiation counters installed in the satellite showed a fluctuation of only 10% in the count rate for high-energy particles (E > 100 kev). Graphs are given that illustrate this phenomenon. The highest intensity of soft electrons in the outer radiation belt between 30 January and 17 February 1964 was $\sim 3\cdot 10^8$ $cm^{-2}\cdot sec^{-1}$,

L 2885-66
ACCESSION NR: AT5023603

in each component direction. Its threshold was 2×10^{-5} erg. The satellite measurements, when compared with solar activity data in the form of K_p indexes recorded via ground observatories, show inconsistencies in the correlation between the variation of magnetic activity on the Earth's surface and the variation of the geomagnetic field intensity and charged particle flux as measured by the satellite. It is uncertain whether these observations can be explained by the solar wind penetrating the magnetosphere or by near-earth plasma due to charged particles accelerated by a yet unknown mechanism. Orig. art. has: 6 figures. [BD]

ASSOCIATION: none

SUBMITTED: 02Sep65 ENCL: 00 SUB CODE: ES, SV

NO REF SOV: 003 OTHER: 008 ATD PRESS: 4109

Card 2/2

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

L 2885-66 FSS-2/EWT(1)/FS(v)-3/FCC/EWA(d)/EWA(h) TT/GS/GW

ACCESSION NR: AT5023603

UR/0000/65/000/000/0336/0341

AUTHOR: Gringauz, K. I.; Dolginov, Sh. Sh.; Bezrukikh, V. V.; Yeroshenko, Ye. G.; Zhuzgov, L. N.; Musatov, L. S.; Solomatina, E. K.; Fastovskiy, U. V.

TITLE: Comparison of simultaneous measurements of magnetic field and positive ion flux within the Earth's magnetosphere recorded by the Elektron-2 satellite

SOURCE: Vsesoyuznaya konferentsiya po fizike kosmicheskogo prostranstva. Moscow, 1965. Issledovaniya kosmicheskogo prostranstva (Space research); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 336-341

TOPIC TAGS: space environment, ionospheric physics, electron density, ion density, earth magnetic field/Elektron 2 satellite

ABSTRACT: Measurements of charged-particle flux and magnetic field at a height of 6—11.6 R (R, Earth's radius) were made by Elektron-2. The particle trap used was capable of recording positive ion flux with ion energy in excess of the potential difference of the satellite with respect to its environment and electron flux with electron energy in excess of 100 ev. The magnetometer, with orthogonally arranged sensors, was capable of measuring the magnetic field in the range of ±120 x 10^{-5} erg

L 1282-66 EWT(1)/FCC/EWA(h) GS/GW

ACCESSION NR: AT5023602 UR/0000/65/000/000/0334/0336

38
B+1

AUTHOR: Gringauz, K. I.
55

TITLE: Interplanetary plasma (solar wind)

55, 12 55

SOURCE: Vsesoyuznaya konferentsiya po fizike kosmicheskogo prostranstva. Moscow, 1965. Issledovaniya kosmicheskogo prostranstva (Space research); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 334-336

TOPIC TAGS: solar wind, magnetic field, interplanetary space

ABSTRACT: The author briefly reviews the literature on solar wind with particular regard to Chapman's static and Parker's dynamic models of the interplanetary plasma. It is concluded that the experimental data relating to the plasma and to the magnetic fields in interplanetary space support Parker's theory in principle, although individual details of this model must be re-examined. [14]

ASSOCIATION: none

SUBMITTED: 02Sep65 ENCL: 00 SUB CODE: AA

NO REF SOV: 003 OTHER: 010 ATD PRESS: 4102

Card 1/1 MLR

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

L 2799-66 EWT(1)/FCC/EWA(h) GS/GW

ACCESSION NR: AT5023579 UR/0000/65/000/000/0177/0184

24

B+1

AUTHOR: Bezrukikh, V. V.; Gringauz, K. I.

TITLE: Outer region of the terrestrial ionosphere (from 2000 to 200,000 km)

SOURCE: Vsesoyuznaya konferentsiya po fizike kosmicheskogo prostranstva. Moscow, 1965. Issledovaniya kosmicheskogo prostranstva (Space research); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 177-184

TOPIC TAGS: ionosphere, astronautics

ABSTRACT: The article is a survey of information presently available on the outer region of the ionosphere above 2000 km. It is pointed out that the peripheral region of the ionosphere is of interest from both a scientific and an engineering viewpoint due to the rapid development of astronautics. Orig. art. has: 6 figures, 1 table. [14]

ASSOCIATION: none

SUBMITTED: 02Sep65 ENCL: 00 SUB CODE: ES

NO REF SOV: 007 OTHER: 012 ATD PRESS: 4102

BVK

Card 1/1

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

GRINGAUZ, K.I., doktor tekhn. nauk

Circumterrestrial and interplanetary plasma. Vest. AN SSSR 35 no.5:60-66 My '65. (MIRA 18:6)

L 1540-66

ACCESSION NR: AT5023577

SUBMITTED: 02Sep65 ENCL: 01 SUB [illegible] SV

NO REF SOV: 007 OTHER: 014 ATD PRESS: 4094

Card 3/3

L 2540-6

ACCESSION NR: AT50?????

a period of decreased solar activity; 2) to investigate the ionospheric regions above 1000 km under nocturnal and twilight conditions; 3) to measure the positive ion temperature by means of a new method using honeycomb-type ion traps with a very narrow directivity pattern; 4) to sound both the ion and electron components of the ionospheric plasma in order to measure the electron temperature and concentration (from ~212 to 600 km) by means of cylindrical Langmuir probes; and 5) to use a system of plane ion-traps for determining the satellite attitude with respect to its velocity vector. A honeycomb-type ion trap is shown in Fig. 1 of Enclosure. It consists of three electrodes (collector, antiphotoelectron grid for suppressing photocurrent on collector surface, and an external honeycomb cap, connected to the satellite). The maximum current in such a trap is achieved when the velocity vector of the incident ion beam is normal to the collector. In addition to the above experiments, measurements of the variation in photoemission from metals (due to the short-wave solar radiation in the frequency region near the ionization maximum of the F-region) were made to determine the total ultraviolet absorption in the F-region. It is stated that the experimental results from the Kosmos-2 mission will be helpful in preparing new ionospheric studies. Orig. art. has: 1 table, 6 formulas, and 15 figures. [YK]

ASSOCIATION: none

Card 2/3

L 1540-66 EWG-2/EWT(1)/EWT(m)/FS(v)-3/EPF(c)/FCC/EWA(h) RPL TT/WW/GS/GW
ACCESSION NR: AT5023577 UR/0000/65/000/000/0151/0167

AUTHOR: Afonin, V. V.; Breus, T. K.; Gdalevich, G. L.; Gorozhankin, B. N.; Rybchinskiy, R. Ye.; Gringauz, K. I.

TITLE: Kosmos-2 ionosphere experiments

SOURCE: Vsesoyuznaya konferentsiya po fizike kosmicheskogo prostranstva. Moscow, 1965. Issledovaniya kosmicheskogo prostranstva (Space research); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 151-167

TOPIC TAGS: artificial earth satellite, ionosphere, ionosphere composition, ionospheric plasma, ion temperature, electron temperature, ion trap, honeycomb trap, metal photoemission, F region, Kosmos 2

ABSTRACT: The Kosmos-2 artificial earth satellite, launched on 6 April 1962 into an orbit from 49°N to 49°S (perigee ~212 km and apogee ~1546 km), was intended for the structural study of the ionosphere and the attendant characteristic processes therein. In addition to a direct telemetering system, information storage equipment was installed on board the satellite. The principal tasks of the satellite were: 1) to remeasure the ion concentration and the chemical composition of the ionospheric region from 500 to 1000 km (first done in 1958 by the third Soviet Sputnik) during

L 14856-66 EWA(h)/EWT(l)/ETC(f)/EWG(m)/FCC IJP(c) AT/GW

ACC NR: AR5012218 UR/0313/65/000/004/0038/0038

SOURCE: Ref. zh. Issledovaniye kosmicheskogo prostranstva. Otdel'nyy vypusk, Abs. 4.62.266 57 B

AUTHOR: Gringauz, K.I.

TITLE: The ionosphere and plasma in near outerspace, according to data from Soviet rocket investigation

CITED SOURCE: Geofiz. byul. Mezhduved. geofiz. kom-t pri Prezidiume AN SSSR, no. 14, 1964, 110-115

TOPIC TAGS: plasma, ~~tropsphere~~ troposphere, ionosphere, particle scatter, magnetic field

TRANSLATION: This is a review article explaining the evolution of problems concerning the ionosphere for the years (1957-1960). Based on experimental data (rockets, sputniks, cosmic rockets) a model of the ionosphere is created, covering an area of the atmosphere ranging from 100 to 20,000 km in altitude. Special attention is given to the problem of the outer belt of charged particles, the boundary of which is connected to magnetic field force lines. Orig. art. has: 15 references. B.M.

SUB CODE: 04,03

Card 1/1

L 23291-65
ACCESSION NR: AP5001986

surface and the intensities of fluxes of positive ions and the magnetic field far from the earth. This correlation was observed on quiet days and on days with magnetic disturbances. Numerous negative ion fluxes were recorded on magnetically quiet days. During this time, the magnetometer recorded a magnetic field of regular intensity although it exceeded the theoretical field by 20 γ. The maximum deflection from the theoretical field was detected at the apogee of the satellite. On 12 February 1964, all magnetic observatories on the earth recorded magnetic disturbances of sudden commencement while the trap in the satellite recorded positive ion fluxes excusively of an intensity of $4 \cdot 10^{-10}$ amp. At this time the satellite was at apogee. The magnetometer recorded a rapid increase in the magnetic field. Orig. art. has: 4 figures. [EG]

ASSOCIATION: none

SUBMITTED: 15Sep64 ENCL: 00 SUB CODE: ES, SV

NO REF SOV: 003 OTHER: 008 ATD PRESS: 3173

Card 2/2

L 23291-65 EWT(1)/FSF(h)/FSS-2/FS(v)-3/EWG(s)-2/FCC/EWA(d)/EEC(t) Po-4/Pe-5/Pq-4/
ACCESSION NR: AP5001986 Pae-2/Pi-4 TT/ S/0020/64/159/006/1272/1275
GW

AUTHOR: Gringauz, K. I.; Dolginov, Sh. Sh.; Bezrukikh, V. V.; Yeroshenko, Ye. G.; Zhuzgov, L. N.; Musatov, L. S.; Solomatina, E. K.; Fastovskiy, U. V.

TITLE: Observations using the artificial satellite Electron-2 of the correlation between variations of the magnetic field and streams of positive ions inside the terrestrial magnetosphere

SOURCE: AN SSSR. Doklady, v. 159, no. 6, 1964, 1272-1275

TOPIC TAGS: artificial satellite, magnetometer, positive ion, geomagnetic field, magnetosphere, radiation belt, flux intensity, negative ion, theoretical field, apogee distance

ABSTRACT: The artificial satellite Electron-2, equipped with magnetometers and a trap for charged particles, recorded positive ions of all energies, their fluxes with energies of more than 100 ev, and measured all three components of the geomagnetic field in the magnetosphere and at radiation belts. Recorded data showed a correlation between the variations of the magnetic activity on the terrestrial

Card 1/2

L 13675-63
ACCESSION NR: AP3003851

3

apparently as a result of reduced solar activity in 1962. "The authors express their gratitude to G. N. Zlotin and I. D. Dmitriev for their substantial aid in processing the results of the experiments." The article was presented by Academician A. L. Mints on 28 Feb. 1963. Orig. art. has: 2 figures and 4 formulas.

ASSOCIATION: none

SUBMITTED: 14Feb62	DATE ACQ: 15Aug63	ENCL: 00
SUB CODE: AS	NO REF SOV: 007	OTHER: 006

Card 3/3

L 13675-63

ACCESSION NR: AP3003851

of the satellite. In the latter type the input grid was swept with a dual-polarity sawtooth voltage of 2-sec duration. Both trap types used suppressor grids next to the collectors to minimize photo- and secondary-emission effects. The collector current registered in the traps could be stored and later interrogated at rates up to 12 times a sec when the satellite was in range of Soviet tracking stations. Sample graphs for several orbits are given which show the variation in total positive ion density as a function of satellite altitude based on data from the planar traps. The graphs verify the general decrease in positive ion density with altitude found by earlier U.S. and Soviet satellites, but reveal a significantly higher dropoff rate above the altitude of maximum ion density. This is confirmed by data from the spherical traps, in which the slope of the volt-ampere characteristic was used in conjunction with mass spectrographs to relate ion concentration to respective mass number. By assuming that only O^+ and He^+ need be considered, the total ion concentration at any orbital altitude was thus divided between these two, showing O^+ dominating at lower levels (≈ 520 km) and giving way to He^+ at increased altitudes (≈ 620 km). The sharp dropoff in density as well as the appearance of dominant He^+ at lower altitudes than heretofore noted suggest that the ion transfer region was significantly lower at the time of the Kosmos flight than in the 1958-1960 period,

Card 2/3

L 13675-63 EPF(c)/EWT(l)/EWT(m)/FCC(w)/FS(v)/BDS/EEC-2/ES(v) AEDC/ASD/
AFFTC/AFMDC/ESD-3/APGC/SSD Pr-4/Pg-4/Pi-4/Pl-4/Po-4/Pq-4/Pe-4 TT/JW/GJ

ACCESSION NR: AP3003851 S/0020/63/151/003/0560/0563 105 101

AUTHOR: Gringauz, K. I.; Gorozhankin, B. N.; Shyutte, N. M.; Gdalevich, G. L.

TITLE: Altitude distribution of charged particles in the ionosphere and the transfer region between oxygen and helium ion layers from ion trap data taken by the Cosmos II satellite

SOURCE: AN SSSR. Doklady*, v. 151, no. 3, 1963, 560-563

TOPIC TAGS: Cosmos satellite, Cosmos II, ionosphere, ionospheric oxygen, ionospheric helium, ionized layer, ion transfer region, ion density, ion concentration, mass spectroscope, mass spectrograph

ABSTRACT: The ion traps used in the flight of Cosmos II, which was launched in April, 1962, are described briefly, and some conclusions are drawn from data produced by them about the relative densities of He^+ and O^+ ions in the upper ionosphere. One trap was of the planar type, containing three electrodes and having its input grid at satellite skin potential; eight of these were located evenly-spaced over the satellite surface. The second type was a spherical trap, which was fixed to a boom 65 cm long in order to position it outside the plasma sheath

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

GRINGAUZ, K.I.; BEZRUKIKH, V.V.; BALANDINA, S.M.; OZEROV, V.D.; RYBCHINSKIY, R.Ye.

Direct observation of solar plasma streams at a distance about 1,900,000 km.from the earth on February 17, 1961, and simultaneous observations of the geomagnetic field. Isk.sput. Zem. no.15:98-101 '63. (MIRA 16:4)

(Solar radiation) (Plasma (Ionized gases))

(Magnetism, Terrestrial--Observations)

L 16950-63

ACCESSION NR: AT3006864

current. The authors conclude that the values of electron flows up to 40 Kev determined by means of three-electrode traps are only two to three times lower than the actual values and that, consequently, the evaluation of such electron flows by means of these traps is correct. This confirms the contention that soft electron flows in the second radiation belt do not exceed 2×10^{-7} e.cm^{-2}.sec^{-1} to 3×10^{7} e.cm^{-2}sec^{-1}. Orig. art. has: 4 figures.

ASSOCIATION: none

SUBMITTED: 20Apr62 DATE ACQ: 29Jul63 ENCL: 01

SUB CODE: GE, AS NO REF SOV: 007 OTHER: 010

Card 3/4?

L 16950-63
ACCESSION NR: AT3006864

0

passage of spaceships through the second radiation belt was not accidental and to evaluate the errors in determining the electron flows in the outermost belt. A schematic of the experiment is shown in Fig. 1 of the Enclosure. The electron flow formed by electron gun 1 was focused by means of cylinder 2. Variation in cylinder voltage in relation to plate 3 made it possible to regulate the electron energy in the range from 150 ev to 40 Kev. Control measurements of the value of the total current were made by means of special probe 4. The degree of electron-flow focussing was checked by means of luminiscent screen 5. Trap 6 was able to turn in relation to the direction of electron flow and its internal and external grid voltages could be altered during the experiment. Measurements confirm that the coefficient of secondary-electron emission decreases with an increase in primary electrons. The negative collector current decreases in absolute value with an increase in the electron energy in the incident flow. At the same time, in an incident flow, variations in internal grid potential within the range of -150 to -200 v have no effect on collector

Card 2/4 3

L 16950-63 EWT(1)/FCC(w)/FS(v)-2/BDS/EEC-2/ES(v) AEDC/AFFTC/ASD/ AFMDC/ESD-3/APGC Pe-4/Pi-4/Po-4/Pq-4 TT/GW

ACCESSION NR: AT3006864 S/2560/63/000/015/0092/0097 86

AUTHOR: Gringauz, K. I.; Balandina, S. M.; Bordovskiy, G. A.; Shyutte, N. M.

TITLE: On the results of tests with three-electrode charged-particle traps in the second and in the outermost radiation belts of the charged particles

SOURCE: AN SSSR. Iskusst. sputniki Zemli, no. 15, 1963, 92-97

TOPIC TAGS: second radiation belt, outermost radiation belt, radiation belt, three electrode trap, trap, soft electron flow

ABSTRACT: Three-electrode traps, identical in design to those placed in the second Soviet space satellite, were irradiated with electrons of energies previously attributed to the soft electrons in the second and the outermost radiation belts surrounding the earth. The purpose of the experiment was to prove the contention that the absence of high negative currents in the traps during the

Card 1/43

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

L 10276-63 BDS/EWT(1)/FS(v)/EEC-2/ES(v)/ES(t)-2--AFFTC/AFMDC/
APGC/ASD/ESD-3/SSD--Pe-4/Pg-4/Pi-4/Pk-4/Pl-4/Po-4/Pq-4--GW/BC/WR/AST
ACCESSION NR: AP3000990 S/0109/63/008/006/0942/0949

AUTHOR: Gdalevich, G. L.; Gringauz, K. I.; Rudakov, V. A.; Ry*tov, S. M. 100

TITLE: Effect of the ionosphere on the position finding of space rockets [Report of the Thirteenth International Astronautical Congress held in Varna September 1962]

SOURCE: Radiotekhnika i elektronika, v. 8, no. 6, 1963, 942-949

TOPIC TAGS: space rocket, effect of ionosphere

ABSTRACT: Some ideas are set forth about calculating the errors caused by the ionosphere in determining coordinates and speed of space rockets by radio means. Assuming a geometrical-optics approximation and measurements at frequencies over 5 x 10 sup 7 cps, formulas are derived for the ionosphere-caused errors in determining range, elevation, and speed of rockets. The rocket is assumed to be in outer space, and errors due to the troposphere and interplanetary plasma are neglected. Approximation of the real altitude distribution of electron concentrations is discussed for purposes of evaluating the above errors. Western and Soviet data on electron concentrations are compared. Orig. art. has: 9 formulas and 6 figures.

Card 1/2

ACCESSION NR: AP4016061

of the emitters at various altitudes and retarding potentials permitted an evaluation of the absorption of solar ultraviolet radiation in the ionospere. Orig. art. has: 7 figures.

ASSOCIATION: Akademia Nauk ZSRR (Academy of Sciences SSSR)

SUBMITTED: 00 DATE ACQ: 10Feb64 ENCL: 00

SUB CODE: PH, GE NO REF SOV: 002 OTHER: 005

Card 2/2

ACCESSION NR: AP4016061 P/0048/63/000/004/0002/0004

AUTHOR: Gringauz, K. I.; Gorozhankin, B. N.; Shutte, N. M.; Gdalewicz, G. L.

TITLE: Some experiments carried out aboard the satellite "Cosmos-2"

SOURCE: Astronautyka, no. 4, 1963, 2-4

TOPIC TAGS: ionospheric satellite measurement, solar ultraviolet radiation measurement, photoelectric current measurement, ionospheric research, positive ion measurement, photoelectron emitter, artificial earth satellite instrumentation, retarding potential

ABSTRACT: The article gives additional results of experiments carried out aboard "Cosmos-2" (launched 6 April 1962), involving measurements of the density of positive ions surrounding the satellite. The results of these measurements provide additional support for the hypothesis that the structure of the ionosphere has undergone considerable change since the period of maximum solar activity, probably owing to the cooling of the upper atmosphere, which caused a drop of the heavy constituents in the ionosphere. In addition, the article describes another experiment, designed to investigate the electric currents induced in emitters of photoelectrons by solar ultraviolet radiation. An analysis of the photoelectric currents

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

GRINGAUZ, K.I.

Discussion of problems of space research at the 14th general assembly of the International Scientific Radio Association. Kosm. issl. 1 no.3:472-479 N-D '63. (MIRA 17:4)

GRINGAUZ, K.I.

Studying interstellar gases and the ionospheres of planets by means of catchers of charged particles. Kosmos no.1:82-95 '63. (MIRA 16:8)

(Gases, Interstellar)

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

4

GRINGAUZ, K.I., BEZRUKIKH, V.V., MUSATOV, L.S., RYBCHINSKIY, R.YE., SHERONOVA, S.M.

Measurement made in the Earth's Magnetosphere by means of Charged Particle traps aboard the Mars 1 Probe.

Report to be submitted for the 4th International Space Science Symposium (COSPAR) Warsaw, 2-12 June 63

S/560/62/000/013/006/009
I046/I242

Analysis of the results of...

the true altitude of reflection, n-index of refraction for radio waves of frequency ω. The theoretical results are in very good agreement with the experimental a-f characteristics taken at the ionospheric station near the launching site of the rocket on February 21, 1958, August 27, 1958 and October 31, 1958, this being an additional confirmation of the almost monotonic increase in electron concentration with the altitude in the 100 to 300 km range without any stratification. In the second part, Shinn-Kelso coefficients are used in calculating the altitude distribution of electrons from a-f characteristics taken on a dispersion interferometer. The $n_e(h)$-values calculated with 5 coefficients for altitudes up to the maximum F_2 (in the absence of the sporadic E_s layer) deviate from the experimental data by no more than 15%. There are 7 figures.

SUBMITTED: February, 1962

Card 2/2

43210

S/560/62/000/013/006/009
1046/1242

AUTHORS: Gringauz, K.I. and Gdalevich, G.L.

TITLE: Analysis of the results of simultaneous measurements of electron concentration in the ionosphere with the aid of ionospheric stations and rockets

SOURCE: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli. no. 13. Moscow, 1962, 89-96

TEXT: In the first part, altitude-frequency characteristics are obtained by numerical integration of the basic equation $H_a = \int_0^H \frac{dh}{h}$, making use of the experimental $n_e(h)$-curves recorded on rockets. Here H_a is the "actual" attitude of reflection, H-

Card 1/2

Results of experiments carried out in the interplanetary space...

PRESENTED at the Internation Symposium on Space Research, Florence, April 10-14, 1961

Card 2/2

3/560/62/000/012/010/014
I046/I246

AUTHOR: Gringauz, K.I.

TITLE: Results of experiments carried out in the interplanetary space with traps of charged particles mounted on Soviet cosmic ships

SOURCE: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli, no. 12, Moscow. 1962, 119-132

TEXT: The author reviews a) the design and the arrangement of three-electrode traps, for charged particles with energies below the cosmic ray minimum, mounted on all Soviet cosmic rockets up to February 12, 1961 (the Venus ship); b) the evidence in favor of the outmost radiation belt (50.10^3 km $\leqslant R \leqslant 75.10^3$ km, 2 keV $\leqslant E \leqslant$ 20 keV, $N \approx (1.5$ to $4).10^8$ $cm^{-2}.sec^{-1}$); c) the data on the solar corpuscular stream (flux density of positive particles $N \approx 10^9$ $cm^{-2}.sec^{-1}$); d) the most recent determination of the density of the interplanetary ionized gas ($n_{0i} \approx 1.5$ cm^{-3} at variance with all the modern conceptions and theories on the stationary interplanetary plasma that set the corresponding concentrations at about 10^3 cm^{-3}). There are 10 figures.

Card 1/2

The structure of the ionized envelope of the Earth...

PRESENTED at the International Symposium on Space Research, Florence, April 10 to April 14, 1961

Card 2/2

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

S/560/62/000/012/009/014
I046/I246

11.1530

AUTHOR: Gringauz, K.I.

TITLE: The structure of the ionized envelope of the Earth from direct measurements of local concentrations of charged particles in the USSR

SOURCE: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli, no. 12, Moscow. 1962, 105-118

TEXT: Reviewing the results obtained with the first, the second and the third Soviet orbital ships, and with the third Soviet artificial satellite at $h < 4R_{earth}$, the author points out that a) the height gradients of electron concentration depend strongly on the time of measurement; b) negative ions exist in the ionospheric F region in vanishing amounts, so that the electron concentration is approximately equal to the concentration of positive ions there; c) the Earth is surrounded by an ionized gaseous envelope of thickness $h \approx 4R_{earth}$ where the ion concentration is 10^3 cm^{-3}, i.e., considerably higher than the concentration of ions in the interplanetary medium; d) at $h \sim (1 \text{ to } 1.7).10^3$ km the oxygen atmosphere is replaced with a hydrogen atmosphere that extends up to $h \sim (20 \text{ to } 22).10^3$ km. There are 12 figures and 3 tables.

Card 1/2

GRINGAUZ, K. I.

"Rocket and satellite investigations of the ionosphere by means of probe methods"

report to be submitted for the 13th Intl. Astronautical Congress, IAF, Varna, Bulgaria, 23-29 Sep 1962.

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

GRINGAUZ, K. I., BEZRUKIKH, V. V., BALANDINA, S. M., OZEROV, V. D., RYBCHINSKY, R. Ye.

"Direct Observations of Solar Plasma Streams at a Distance of -1,900,000 KM from the Earth on February 17, 1961, and Simultaneous Observations of the Geomagnetic Field"

Soviet Papers Presented at Plenary Meetings of Committee on Space research (COSPAR) and Third International Space Sumposium, Washington, D. C., 23 Apr - 9 May 62

GRINGAUZ, K. I., BALANDINA, S. M., BORDOVSKIY, G. A., SHUTTE, N. M.

"On the results of the Charged Particle Three-Electrode Trap Experiments in the Second Radiation Belt and in the Outermost Belt of Charged Particles"

Soviet papers Presented At Plenary Meetings of committee on Space Research (COSPAR) and Third International Space Sumposium, Washington, D. C., 23 Apr - 9 May 62.

ILLEGIBLE

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

25989
S/560/61/000/006/007/010
Ionized gas and fast electrons E032/E114

Ref.3: J.A. Van Allen, L.A. Frank. Nature, V.183, 430, 1959.
Ref.5: J.A. Van Allen, L.A. Frank. Nature, V.184, 219 1959.
Ref.6: J.A. Van Allen, C.E. McIlwain, G.H. Ludwig.
J. Geoph. Res., V.64, 271, 1959.
Ref.11: H.C. van de Hulst. Light Scattering by Small Particles.
London, 1957.

Card 4/6

25989

S/560/61/000/006/007/010

Ionized gas and fast electrons E032/E114

at R = 1800 km and above moderate geomagnetic altitudes indicate the presence of electrons with about 10 keV (up to 3×10^8 $cm^{-2}sec^{-1}$). This may mean that in the region of the radiation belts the concentration of soft electrons is a minimum. However, the experiment reported in Ref.8 was not simultaneous with that described in the present paper. The readings of the trap with zero potential over the first section of the trajectory can be used to estimate the plasma ion concentration. Fig.3 shows the plasma ion concentration as a function of the distance from the earth's surface [1 - theoretical distribution with T = 1.8×10^3; 2, 3, 4 - experimental results with T = 1800, 1000 and 5000° respectively; points a and b represent measurements at 470 and 800 km respectively (third artificial earth satellite)]. It follows from Fig.3 that the plasma is not the interplanetary ionized gas, and in fact it is an extended shell which is a part of the ionized component of the outermost part of the earth's atmosphere, i.e. that so called geocorona. There are 3 figures and 12 references: 7 Soviet and 5 non-Soviet. The four most recent English language references read as follows:

Card 3/6

25989
S/560/61/000/006/007/010
E032/E114

Ionized gas and fast electrons .....

($I_c < 6 \times 10^{-10}$ amp); 3) distances in the range 50000-70000 km where negative currents were recorded in all the traps and the absolute maximum and minimum currents were 10^{-9} and 3×10^{-10} amp respectively; 4) distances greater than 70000 km where currents in all the traps oscillated between zero and approximately - (5-6) x 10^{-10} amp, which apparently represents the maximum photoelectric current due to the inner grid which is intercepted by the collector. The overall trend of the results was found to be the same for all the three flights of Soviet space rockets. Analysis of all the results has led the present authors to the scheme indicated in Fig.2 in which 1 is the 'inner' belt, 2 is the 'outer' belt, 3 is the third belt (now postulated), and 4 is the geomagnetic equator. In the region of between 50000 and 70000 km the negative currents of all the traps, which reached 10^{-9} amp, can only be explained by electrons with energies in excess of 200 eV and $N_e \sim 10^8 - 2 \times 10^8$ $cm^{-2}sec^{-1}$. The third belt therefore consists of relatively low energy electrons which explains why previous experiments did not detect its presence. Experiments carried out from the third Soviet artificial satellite (Ref.8: V.I. Krasovskiy, I.S. Shlkovskiy, Yu.I. Gal'perin, Ye.M. Svetlitskiy, Dokl. AN SSSR, V.127, 78, 1959)

Card 2/ 6

25989
S/560/61/000/006/007/010
E032/E114

9,9100

AUTHORS: Gringauz, K.I., Kurt, V.G., Moroz, V.I., and Shklovskiy, I.S.

TITLE: Ionized gas and fast electrons in the earth's neighbourhood and in planetary space

PERIODICAL: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli. No. 6. Moscow, 1961. pp. 108-112

TEXT: This paper was first published in Doklady AN SSSR, Vol.132, page 1062, 1960.
K.I. Gringauz, V.V. Bezrukikh, V.D. Ozerov and R.E. Rybchinskiy (present issue, page 101 - Ref.1) showed that the first half of the trajectory of the second Soviet space rocket can be divided into four parts, namely: 1) distances up to R = 22000 km (R is the distance from the earth's surface) where all the traps with negative or zero potential recorded appreciable collector currents, while the trap whose potential relative to the body was + 15 V showed either very small negative currents or no current at all; 2) distances in the range 22000-50000 km, where collector currents in all the traps varied between zero and some negative values

Card 1/ 6

Legend, Fig.1
1 - body of the container;
2 - outer grid;
3 - inner grid;
4 - collector;
5 - to amplifier.

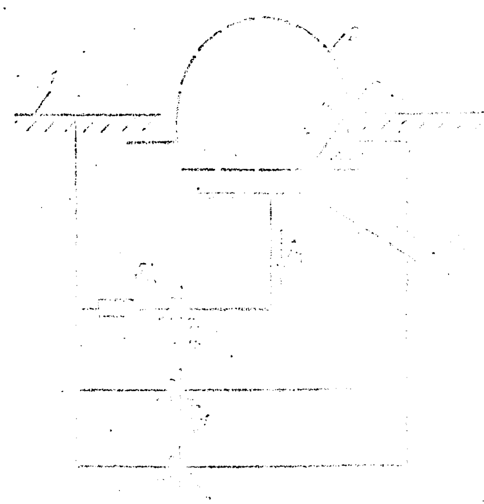


Fig.1

25988
S/560/61/000/006/006/010
A study of the interplanetary ionized.... E032/E114

belong to solar corpuscular emission. These results therefore, constituted the first direct observation of corpuscular radiation outside the earth's magnetic field.
There are 4 figures and 5 references: 3 Soviet and 2 non-Soviet.
The English language reference reads as follows:
Ref.3: L. Bierman. The Observatory, V.77, 187, 1957.

X

Card 5/7

container can, at least to some extent, be excluded. Consideration of the experimental data has led to the following conclusions. A plasma having a temperature not greater than some tens of thousands of degrees was present at distances of up to 4 earth radii from the earth's surface. The estimates of the concentration of the plasma are given by K.I. Gringauz, V.G. Kurt, V.I. Moroz and I.S. Shklovskiy in Ref.5 (page 108 of the present issue). In the region between 55000 and 75000 km an electron flux of about 10^8 cm^{-2}sec^{-1}, which consisted of electrons having energies in excess of about 200 eV, was recorded. The existence of such an electron flux in this region is confirmed by results obtained with the first space rocket in January 1959. Beginning at 9 hr 30 min Moscow time, on September 13 1959 and right up to the impact on the lunar surface, the probe passed through a positive ion stream (probably protons). The energies of these particles were in excess of 15 eV and the flux was about 2×10^8 cm^{-2}sec^{-1}. The existence at various times of a stream of protons with energies in excess of 25 eV was discovered with the aid of similar apparatus at various distances from the earth during the flight of the Automatic Planetary Station during October 1959. These protons apparently

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

current since they cannot overcome the retarding field due to the potential difference between the inner and the outer grids. On the other hand, electrons moving in the earth's magnetic trap (the so-called outer radiation belt) do have sufficient energy to overcome the field between the two grids and can give rise to a negative collector current. The collector current amplifiers were sufficient to transmit information about the magnitude of the positive collector currents in the range 10^{-10} - 50×10^{-10} amp and negative collector currents in the range 10^{-10} - 15×10^{-10} amp. During its translational motion the container also performed complicated and rapid rotational motion. The angular position of each trap was therefore subject to continuous variation giving rise to oscillations in the collector current. This is illustrated in Fig.2, which gives a plot of the collector currents as a function of distance R (km) for the trap with $\phi_{g2} = -10$ volt. The maximum and also the minimum values correspond to roughly the same orientations. Thus, changes in the collector current which are mainly due to the surrounding medium can be described by curves passing through points corresponding to the successive maxima and minima in the collector current. In this way, the rotation of the

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

up on the surface of the space probe and were located at the corners of a tetrahedron inscribed into a sphere. Each trap consisted of a hemispherical outer nickel grid (radius 30 mm) with a plane nickel collector inside the grid. A plane tungsten grid was placed between the collector and the outer grid. The arrangement is illustrated in Fig.1. The potentials of the electrodes relative to the body of the container were: collectors - (60-90) volts, inner grids (g1) - 200 volts, outer grids (g2) - 10, -5, 0 and + 15 volts respectively. The main function of the inner grid was to suppress the photo-electrons from the collectors which are ejected by ultraviolet solar radiation, and to suppress the secondary electron emission due to the bombardment of the collectors by electrons and protons. The various potentials were applied to the outer grids in order to be able to estimate the energy of positive particles and to differen-tiate between current produced by protons of the interplanetary stationary plasma ($\sim$ 1 eV) and current due to protons in corpuscular streams whose energies are higher by three orders of magnitude. Electrons belonging to the stationary plasma and solar corpuscular streams with energies up to 25 eV do not give rise to a collector

9.9100 (also 2605)
11.1530

25988
S/560/61/000/006/006/010
E032/E114

AUTHORS: Gringauz, K.I., Bezrukikh, V.V., Ozerov, V.D., and Rybchinskiy, R.Ye.

TITLE: A study of the interplanetary ionized gas, energetic electrons and solar corpuscular emission using three-electrode charged-particle traps on the second Soviet cosmic rocket

PERIODICAL: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli. No. 6. Moscow, 1961. pp. 101-107

TEXT: This paper was first published in Doklady AN SSSR, Vol.131, p.1301 (1960).
The first, second and third Soviet space rockets carried three-electrode charged-particle traps. The most valuable data were obtained with the second space rocket (12000 collector current measurements). The present paper is therefore largely concerned with the data obtained during the latter flight. The space rocket which was fired in the direction of the moon on September 12 1959 carried equipment designed to measure interplanetary ionized gas, electrons with energies in excess of 200 eV, and also the corpuscular solar radiation. Four three-electrode traps were set

Card 1/7

Fig.8 shows the theoretical volt-ampere characteristics for spherical probes (curves 1 and 2) and a part of an infinitely large plane probe (curves 3 and 4). In computing these curves it was assumed that $T = 0°$ (curves 1 and 3), $T = 2000°$ (curves 2 and 4); $m_i = 16$ amu, $v_{orb} = 8 \times 10^5$ cm/sec. In fact, curves 1 and 2 represent the present theory and curves 3 and 4 represent Whipple's theory. During the flight of the third satellite more than 10 000 ion volt-ampere characteristics corresponding to different altitudes were obtained. It is stated that rotational effects were clearly distinguishable and could easily be eliminated. Analysis of the ion volt-ampere characteristics (25 such characteristics corresponding to different altitudes are reproduced in this paper) has led to altitude distributions of positive ion concentration between 600 and 1000 km. Figs. 38-43 show some of these distributions. The dashed parts of the curves indicate the absence of reliable data. There are 43 figures, 2 tables and 18 references: 10 Soviet and 8 non-Soviet. The four most recent English language references read as follows:

Ref.4: W.W. Berning. Proc. IRE, V.47, 280, 1959.
Refs. 5, 6, and 7 as quoted above.

SUBMITTED: March 22, 1960

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

of its electric field which distorts the ion trajectories, nor did he take into account the thermal velocity components which lie in the plane perpendicular to the velocity of the satellite. It is stated that Whipple's results strictly apply only to a part of an infinite plane probe. The present authors show that, assuming the ion velocity distribution to be of the form

$$dn_i = n_i \left(\frac{m_i}{2\pi kT}\right)^{3/2} \cdot \exp\left\{-\frac{m_i}{2kT}\left[(v_{i,x} - V_{c\pi,x})^2 + (v_{i,y} - V_{c\pi,y})^2 + (v_{i,z} - V_{c\pi,z})^2\right]\right\} dv_{i,x} dv_{i,y} dv_{i,z} \tag{10}$$

where subscript i refers to the ions and subscript $c\pi$ refers to the satellite, the correct expression for the collector current is of the form:

$$dI_{k,i} = \alpha S e n_i \left(\frac{m_i}{2\pi kT}\right)^{3/2} \exp\left\{-\frac{m_i}{2kT}\left[(v_{i,x} - V_{c\pi,x})^2 + (v_{i,y} - V_{c\pi,y})^2 + (v_{i,z} - V_{c\pi,z})^2\right]\right\} v_i \left(1 - \frac{2e\varphi}{m_i v_1^2}\right) dv_{i,x} dv_{i,y} dv_{i,z} \tag{11}$$

25987
S/560/61/000/006/005/010
E032/E114

Results of measurements of the ....

shunted the input resistor, thus reducing the amplification coefficient. Special facilities were provided for spot checks of all the supplies, fields and currents. The sawtooth positive and negative voltage pulses were produced by special oscillators set up on the satellite. In order to economise on energy consumption all the filaments were supplied from 3 v sources. The present authors state that Whipple (Ref.7: E.C. Whipple, Proc. IRE, V.47, 2023, 1959) has derived an expression for the volt-ampere characteristic of the ion traps on the third Soviet satellite and applied it to the data reported by the present authors in Ref.3 (V.I. Krassovskiy, Proc. IRE, V.47, 289, 1959). Whipple based his calculation on the assumption that the components of the ion velocities in the direction of motion of the satellite are distributed in accordance with the Maxwellian law. Whipple concluded that the determination of n_i (the ion density) reported by K.I. Gringauz and M.Kh. Zelikman (Ref.1) and V.I. Krassovskiy (Ref.2: same journal, No.2, izd-vo AN SSSR, 1959, p.36; and Ref.3) is incorrect. It is pointed out by the present authors that Whipple's theory cannot be applied to spherical ion traps since he did not take into account the spherical form of the trap and the associated quasi-radiality

Card 4/14

charge. A block diagram of the apparatus is shown in Fig.3. The instantaneous values of the voltage amplitudes applied to the trap envelopes, and of the collector currents in the two traps, were telemetered to the earth. In this way it was possible to plot for each trap the complete ion volt-ampere characteristic, corresponding to each bipolar pulse. With $\varphi \sim 0$ and an ion concentration of 10^7 cm^{-3}, the collector current due to positive ions was of the order of 3×10^{-5}A, while with a concentration of 10^4 cm^{-3} this current was of the order of 5×10^{-8} A. The amplification of such currents presented no particular difficulty. The currents were in fact amplified with the aid of cathode followers with high input resistors and 6Н16Б (6N16B) tubes whose grid current is of the order of a few 10^{-9} A. In order to cover the entire range (5×10^{-8} - 2.5×10^{-5} A) with a single amplifying stage it was necessary to introduce a nonlinear element, i.e. a diode, which was put in parallel with the input resistor of the amplifier and was cut off by a special bias voltage. When the input current exceeded 10^{-6} A the voltage drop across the input resistor compensated the bias voltage and the diode began to conduct and fixed to the surface of the satellite as shown in Fig 1. The traps had a central spherical collector kept at ~ -150 v relative to the body of the satellite. The radius of the outer shell was 5 cm and the diameter of the collector 3 cm. The transparency of the outer grid was approximately 0.63. Both the outer grids and the collectors were made from chromium coated brass. The electrical field between the outer grid and the central collector was capable of retaining all atmospheric positive ions (with energies of a few fractions of eV). All negative ions whose energy was less than 150 eV were repelled. These ion traps are said to be modifications of the device described by R.L. Boyd (Ref.15: Proc. Roy. Soc., V.201, 1066, 329, 1950). Bipolar voltage pulses relative to the body of the satellite were applied to the grid envelopes of the trap every 2 sec. The positive pulse had an amplitude of 27 v and a duration of 0.13 sec and the negative pulse had an amplitude of 14 v and a duration of 0.07 sec. These gave rise to a change in the potential φ of the grid envelope relative to the undisturbed external plasma and this in its turn resulted in a change in the thickness of the space-charge surrounding the trap. When φ passed through zero there was a change in the sign of this space-

9,9100

3,2100

25987
S/560/61/000/006/005/010
E032/E114

AUTHORS: Gringauz, K.I., Bezrukikh, V.V., and Ozerov, V.D.

TITLE: Results of measurements of the positive ion concentration in the ionosphere using ion traps set up on the third Soviet earth satellite

PERIODICAL: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli. No. 6. Moscow, 1961. pp. 63-100

TEXT: The third Soviet satellite (launched on May 15, 1958) carried apparatus designed to measure the positive ion concentration with the aid of ion traps. A preliminary description of the experiment (prior to the launching) was reported by K.I. Gringauz and M.Kh. Zelikman (Ref.1: UFN, 63, 16, 239, 1957). The preliminary description of the experiment is said to have been echoed in the U.S.A. where similar experiments were later described (Ref.5: W.C. Hoffman, Planetary and Space Science, V.1, 238, 1959; Ref.6: J.W. Townsend, J. Geophys. Res., V.64, 1779, 1959). A general view of one of these ion traps is shown in Fig.2. Two identical traps ($Л_1$ and $Л_2$) of this type were attached at the ends of two rods a_1 and a_2 (65 cm long each) which in turn were

Card 1/14

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

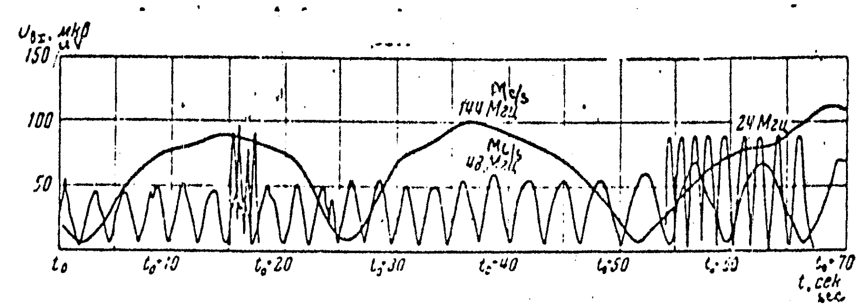
25986

Measurements of the electron S/560/61/000/006/004/010
E032/E114

to 1 July 1958. National Academy of Sciences, Washington, No.1, 1958, p.140.
Ref.14: J.A. Ratcliffe. The Physics of the Ionosphere, published by the Physical Soc., London, 1956, p.89.
Ref.15: J.V. Evans. Prod. Phys. Soc., 69B, 953, 1956.

SUBMITTED: April 29, 1960

Fig.1



Card 8/10

25986

Measurements of the electron S/560/61/000/006/004/010 E032/E114

Fig.3 shows the electron concentration as a function of height (km). The curves were obtained by the dispersion interferometer method. Curve 1 was obtained on February 21, 1958 at 11 hr 40 min; Curve 2 on August 27, 1958 at 8 hr 06 min; Curve 3 on October 31, 1958 at 15 hr 54 min. Fig.4 shows a similar curve obtained on August 27, 1958 with the aid of the Faraday effect. The points 1, 2, 3 and 4 have the following meanings: 1 - identical data at two points of reception; 2 - data at a third point; 3 - identical data at three points; 4 - curve obtained by the dispersion method (at the same time). It is concluded that all the results fully confirm the fact that the ionosphere has a single main maximum in the electron concentrations which occurs at about 300 km, and that the belief that there is a sharply defined E layer was due to the inadequate data which have been available so far. Acknowledgments are expressed to S.M. Rytov for assistance and advice.
There are 6 figures and 18 references: 12 Soviet and 6 non-Soviet. The four most recent English language references read as follows:
Ref.3: H. Friedman, Proc. IRE, V.47, 272, 1959.
Ref.10: J.C. Seddon, J.E. Jackson. IGY World date center A. Experimental results of the U.S. Rocket program for the IGY

25986
S/560/61/000/006/004/010
E032/E114

Measurements of the electron .....

of the Dispersion of Radiowaves in the Ionosphere", M., Svyaz'izdat, 1940). Fig.1 shows a part of the record obtained for the three frequencies $f_3 = 24$, $f_2 = 48$ and $f_1 = 144$ Mc/s. This figure shows a plot of U_{in} (microvolts) at the inputs of the receiver connected to antennas with the same polarization. The $\theta \sim 1/f^2$ relationship is said to be clear from this figure so that the recorded periodic changes must have been due to the Faraday effect. It follows from Eq.(6) that if $\theta = \pi$ then assuming H_L to be known and replacing ΔL by Δh the average electron concentration can be calculated from:

$$n_e = \frac{2\pi^2 c^2 m^2}{e^3} \frac{f^2}{\Delta h} \frac{1}{H_B} \qquad (7)$$

The quantity Δh is determined from the times t_1 and t_2 which correspond on the record to two neighbouring polarization minima, since the coordinates of the rocket are known at each instant of time. The interval of altitudes over which the average of n_e is taken can be reduced by using two receiving devices with independent antennas having mutually perpendicular polarization.

Card 6/10

25986

Measurements of the electron S/560/61/000/006/004/010
E032/E114

the 1936 measurements during the solar eclipse, the first component is absent and the measured phase difference yields the average rate of change in the second component. If the point A is a rocket launched in the vertical direction, then a similar situation occurs at the apex of the trajectory where the vertical velocity changes sign and passes through zero. This method therefore yields the integral electron concentration. In addition to the dispersion effects the electron concentration can also be measured from the rotation of the plane of polarization of the radio waves emitted from a vertically launched rocket. The rotation angle θ can be evaluated from:

$$\dot{\theta} = \frac{e^3}{2\pi c^2 m^2} \frac{1}{f^2} \int_L^{L+\Delta L} H_L n_e(\ell)\, d\ell \qquad (6)$$

where: H_L is the vertical component of the magnetic field and f is the frequency which is sufficiently high for the absorption in the ionosphere to be small and the refractive indices of the two components to approach unity (A.N. Shchukin, "Physical Principles

Card 5/ 10

25986

Measurements of the electron S/560/61/000/006/004/010
E032/E114

$$\Delta\varphi = \frac{e^2}{cmf_2}\left(\frac{p^2 - 1}{p}\right)\int_0^L n_e(\ell)\,d\ell = K\int_0^L n_e(\ell)\,d\ell \qquad (3)$$

If it is assumed that n_e and L are functions of time (i.e. the point A is moving relatively to B) then during a time Δt during which A is displaced through ΔL the change in the phase difference at B is given by:

$$\Delta\Phi = K\left[\int_L^{L+\Delta L} n_e(\ell)\,d\ell + \left(\int_0^L \frac{\partial}{\partial t} n_e(\ell)\,d\ell\right)\Delta t\right] = \Delta\Phi_{лок} + \Delta\Phi_{инт} \qquad (4)$$

The recorded increase in the phase difference consists of two components, namely, one, $\Delta\Phi_{лок}$, due to the increase in the path L, which depends on the electron concentration in this region, and another, $\Delta\Phi_{инт}$ which depends on the total number of electrons in the column between the observer and the beginning of the section ΔL. When the point A is fixed, as for example in the case of

Card 4/10

In this method, coherent radio waves with frequencies f_1 and f_2 are emitted from a point A ($f_1 = pf_2$ where $p = m/n > 1$ and m and n are integers). The radio waves are detected at a point B and the phase difference between them is determined. The phase difference is reduced to the higher frequency, i.e. $\Delta\varphi = \varphi_1 - p\varphi_2$. The phase difference is given by:

$$\Delta\varphi = \frac{2\pi p f_2}{c}\left(\int_0^L n_1(\ell)\,d\ell - \int_0^L n_2(\ell)\,d\ell\right) \qquad (1)$$

where L is the distance between A and B, and the integration is carried out along the path from the transmitting to the receiving antenna; $n_1(\ell)$ and $n_2(\ell)$ are the refractive indices for f_1 and f_2 respectively. For sufficiently short radio waves it may be assumed that:

$$n(f) \approx 1 - \frac{e^2}{2\pi m f^2}\, n_e \qquad (2)$$

where n_e is the electron concentration and f is the frequency. Substituting Eq.(2) into Eq.(3) it is found that:

which are encountered in dispersion and Faraday effect measurements, as used in the determination of the electron concentration. An account is also given of the experimental results obtained in 1958 with three geophysical rockets launched to a height of 450-470 km. These measurements were carried out at different times of day and year and have thus provided information about the electron concentration in the region of the ionosphere which includes the so-called outer ionosphere (above the maximum of the F layers and quite inaccessible by the normal radiosonde methods). All the measurements were carried out above the same geographical point and the same method was used throughout. The velocity of propagation of radio waves in the ionosphere is a function of frequency and to a considerable degree depends on the concentration of free electrons n_e. Hence dispersion methods can be used to determine n_e. The dispersion can be conveniently measured by the radio interference method due to Mandel'shtam and Papaleksi (Ref.6: M - L, Gostekhizdat, 1945, "Recent investigations on the dispersion of radio waves along the earth surface"). The method was first used by Papaleksi in 1936 during the solar eclipse. It is designated by the present authors as the "dispersion interferometer method".

9,9100

25986
S/560/61/000/006/004/010
E032/E114

AUTHORS: Gringauz, K.I., and Rudakov, V.A.

TITLE: Measurements of the electron concentration in the ionosphere up to 420-470 km, carried out during IGY using radio waves emitted from geophysical rockets of the Academy of Sciences, USSR

PERIODICAL: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli. No. 6. Moscow, 1961. pp. 48-62

TEXT: The systematic study of the electron concentration in the ionosphere as a function of altitude was begun in the Soviet Union in 1954. The experiments were carried out with the aid of vertically launched geophysical rockets. The results were first reported by K.I. Gringauz (Ref.1: Dokl. AN SSSR, V.120, 1234, 1958; Sb. "Iskusstvennyye sputniki Zemli" No.1 izd-vo AN SSSR, 1958, p.62) and K.I. Gringauz and V.A. Rudakov (Ref.2: Dokl. AN SSSR, V.132, 1311, 1960), and were "reproduced" by H. Friedman (Ref.3: Proc. IRE, V.47, 272, 1959). The apparatus employed is described by the present authors and A.V. Kaporskiy in Ref.4 (page 33 of the present issue). The present paper is concerned with some problems

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

S/[illegible]/63/00[illegible]

[illegible]

Legend to Fig.7 a - c refer to different parts of [illegible] rocket velocities and electron densities); [illegible] current, [illegible] - signal at the input of the [illegible] [illegible] - time markers (0.25 sec between markers).

Card [illegible]

...ratus for rocket measurements .... S/560/61/...

Card 7/?

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

25895
S/560/61/000/006/003/010
Apparatus for rocket measurements ... E032/E114

with the aid of suitable mixers. The signals at the output of the three channels have the same frequency (84 Mc/s). The working bandwidth of the three channels f_1, f_2 and f_3 is 40, 25 and 15 kc/s. The signals are recorded on a 35 mm film using two methods. The first method makes use of loop oscillograph МПО-2 (MPO-2) which shows the interference-frequency current and also the currents which depend on the voltages at the input to the receiving device. The speed of the film is 100 mm/sec. Typical records are shown in Fig.7. The second method of recording the phase difference makes use of Lissajous figures produced on the screen of a cathode ray tube. Further details are given in Ref.4 (page 48 of the present issue). Acknowledgments are expressed to A.N. Gridin for advice and assistance.
There are 11 figures and 5 Soviet references.

SUBMITTED: April 2, 1960

Card 5/8

25985
S/560/61/000/006/003/010
Apparatus for rocket measurements E032/E114

The coherence of the oscillations is ensured because they are obtained as a result of successive multiplications of the frequency of the common master oscillator. The master oscillator is quartz-stabilized and is placed in a thermostat. The HT supplies are fully transistorized. The transmitting antennas are in the form of symmetric linear vibrators set up in the upper part of the rocket. The frequencies f_1 and f_2 are radiated from a common antenna while a separate vibrator is employed for f_3. The apparatus on the earth's surface is designed to perform the following functions: a) measure the phase difference between f_1 and f_2, and f_1 and f_3; b) measure the amplitude of the high-frequency waves at the inputs of the receivers (a minimum of five microvolts is required); c) record on a 35 mm film the two phase differences, the corresponding amplitudes and suitably scaled time markers. The three frequencies are received by separate antennas. Two photographs are included which show the appearance of the antennas. The receiving apparatus has the form of a three-channel superheterodyne device capable of carrying out the simultaneous detection and measurement of the phase differences. In each channel there is double frequency conversion which is carried out

Card 4/8

radiation of the plane of polarization is due only to the Faraday effect. The electron concentration can then be determined from:

$$n_e = M \frac{\theta}{2\pi H_B \Delta h} \text{ electron} \cdot \text{cm}^{-3} \qquad (2)$$

where: θ is the rotation of the plane of polarization; H_B is the vertical component of the geomagnetic field in oersted; Δh is the path (in km) traversed by the rocket while the plane of polarization is rotated through θ; M is a constant whose value for $f_{1,2,3}$ was 56×10^6, 6.2×10^6 and 1.55×10^6 respectively. In all these measurements it is necessary to know the coordinates of the rocket as functions of time, and hence the recording of the phase and amplitude of the signals must be accompanied by the recording of the time. The apparatus employed in these measurements was developed during 1954-1958 and the present paper describes its latest form. The transmitters mounted on the rocket produce coherent vibrations on the three frequencies f_1, f_2 and f_3. There is a separate output for each frequency with a symmetric load of 100 ohm. The power at the outputs is 15, 8 and 3 watt respectively. A block diagram of the transmitting system is shown in Fig.1.

by the present authors in Ref.4 (page 48 of the present issue). The experiment consists in the determination of the phase difference between the signal transmitted from the rocket and detected at two different points on the earth's surface. The phase difference occurs because of the dispersion of radio waves in the ionosphere. Between 1954 and 1958 the frequencies employed were $f_1 = 144$ Mc/s and $f_2 = 48$ Mc/s. Since 1958 a further frequency $f_3 = 24$ Mc/s has been used. The phase difference between vibrations of differing frequency is defined as $\Delta\varphi = \varphi_1 - p\varphi_2$, where $f_1 = pf_2$ and $p < 1$, i.e. the phase difference reduced to the higher frequency. The average electron concentration n_e can then be calculated from:

$$n_e = k\frac{\Delta\Phi}{2\pi\Delta h} \text{ electron}\cdot\text{cm}^{-3} \qquad (1)$$

where: $\Delta\Phi$ is the phase difference corresponding to an altitude change of Δh (the phase difference is in radians and the altitude change in meters). The coefficient k was 2.25×10^7 for the frequencies $f_{1,2}$ and 0.515×10^7 for $f_{1,3}$. The recorded signals can be used to measure the rotation of the plane of polarization of the received radio waves. With a completely stabilized rocket the

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

25985

9.9100

3.2100

S/560/61/000/006/003/010
E032/E114

AUTHORS: Gringauz, K.I., Rudakov, V.A., and Kaporskiy, A.V.

TITLE: Apparatus for rocket measurements of free electron concentration in the ionosphere

PERIODICAL: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli. No. 6. Moscow, 1961. pp. 33-47

TEXT: The present paper gives a brief description of the radio apparatus which is being used to study the electron concentration as a function of height in the ionosphere. The apparatus is designed so that it can be mounted on a vertically launched geophysical rocket of the Academy of Sciences USSR (K.I. Gringauz. Dokl. AN SSSR V.120, 1234, 1958; Sb."Iskusstvennyye sputniki Zemli" No.1, izd-vo AN SSSR, 1958, p.62, Ref.1: K.I. Gringauz, V.A. Rudakov, Dokl. AN SSSR, V.132, 1311, 1960, Ref.2). The apparatus incorporates radio transmitters and transmitting antennas set up on the rocket, receiving antennas on the earth's surface, receiver-phasometric devices, and recording and auxiliary apparatus. The method of measurement, the choice of the frequencies and the results which have been obtained are reported

Card 1/ 8

40443

3.5131
3.2120

P/048/61/000/003/002/004
1004/1204

AUTHORS Gringauz, K. I., Kurt, W. G., Moroz, W. I., Szkolwski, I. S

TITLE Ionized gas and fast electrons in the vicinity of Earth and in in interplanetar space

PERIODICAL Astronautyka no 3, 1961, 8—10

TEXT The purpose of this work is to analyze the distribution and nature of radiation in the space surrounding earth with regard to the resultant danger to manned space flights. Data gathered by the second Soviet cosmic rocket show that four different concentrations of ions can be distinguished along the first half of its trajectory. In the first portion, extending up to R = 22,000 km (R — the distance from the surface of earth), all counters with negative or zero potential registered high positive collector currents while in counters with + 15 v charge relative to the housing, the currents were either small and negative or zero. In the second portion, between 22,000 and 50,000 km, the collector currents varied between zero and negative values. The third portion, 50,000 - 70,000 km, showed negative current in all traps. Above 70,000 km current values were as in portion 2. The current variations in the "+ 15 V" trap indicate that the electron flux in the outer radiation belt is below $2 \cdot 10^7$ cm^{-2} sec^{-1}. This contradicts the established idea that there exist large electron streams of $E \approx 20$ to 30 kev in the maximum region of the outer radiation belt. It is assumed that the density of the kinetic energy of the electrons there, is by several orders of magnitude smaller than the energy density of the magnetic field of earth. There are 3 figures.

Card 1/1

Venus probe, which registered currents corresponding to a particle flux of $\sim 10^9$ cm^{-2}sec^{-1}. Instruments with multielectrode traps have been prepared which will make it possible to determine not only the density of streams of charged particles but also their energy spectrum. From the point of view of astronautics, the problem of the ionospheres of the various planets is even more important than that of interplanetary plasma, since near the planets one may expect considerable concentrations of charged particles which would have a significant effect on radio-wave propagation. The chemical composition and density of the atmospheres of the planets, as well as the magnetic fields, differ greatly. The concentration of free electrons in the outer radiation belt of the Earth is apparently too low to affect significantly the propagation of radio waves. There is no ground to assume the same for other planets. Installation of equipment (Sputnik III spherical ion traps, three-electrode traps used in space probes, or some variants) aboard an automatic reconnaissance research rocket for the study of a planet's ionosphere will undoubtedly precede manned flight to a particular planet. Also, charged particle traps can be used from the moment

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

E2d(b)/E2b(v)/E1d(g) 3 cys/E3a(w)

JJP(C)
- MJW(JG)
BAW

The following are summaries of papers presented at the XIIth International Astronautical Congress in Washington, D. C., October 4, 1961. Full translations are available at the FTD Library and the Aerospace Information Division, Library of Congress.

INVESTIGATION OF INTERPLANETARY PLASMA AND PLANETARY IONOSPHERES BY MEANS OF CHARGED PARTICLE TRAPS ON SPACE ROCKETS (K.I. Gringauz)

Three-electrode charged particle traps for studying interplanetary plasma were installed on all Soviet space probes, starting with Sputnik I and including the Venus probe launched February 12, 1961. The concentration of stationary interplanetary gas as indicated by Lunik III is unexpectedly low in comparison with earlier assumptions and cannot, therefore, exert a significant influence on the accuracy of radio navigation measurements in interplanetary space. Solar corpuscular streams present the only problem in this area. The ion component of solar corpuscular streams beyond the Earth's magnetic field was recorded for the first time September 13, 1959, during the flight of Lunik II. The most intense stream was recorded by the

1/3 TR AVAIL: FTD Library; also AID Division, LC

GRINGAUZ, K. I.

"Some Results of Experiments in Interplanetary Space with Charged Particles Traps on Soviet Space Probes."

Report presented at the Commission on Space Research, 2nd Intl. Symposium and Plenary Meeting, 7-18 April 1961, Florence Italy.

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

GRINGAUZ, K.I.

"The Structure of the Earth's Ionized Gas Envelope Based on Results of Direct Measurements in the USSR of Charged Particle Local Concentrations" by K.I. Gringauz (USSR)

"Some Results of Experiments in Interplanetary Space with Charged Particles Traps on Soviet Space Probe" by K.I. Gringauz (USSR)

Reports to be submitted for 4th Meeting of the Committee on Space research Florence Italy, 7-18 April 1961

84660

The Interrelation Between the Results of Measurements Carried out With the Help of Charged Particle Traps on Soviet Cosmic Rockets and Measurements of the Magnetic Field by Means of the American Earth Satellite "Explorer VI" and the Rocket "Pioneer-V"

S/020/60/135/001/012/030
B006/B056

estimates were based. It may therefore be assumed that the "current belt", which was discovered by the magnetic measurements, is nothing but a consequence of the inhomogeneities of the field caused by the drift current. There are 12 references: 6 Soviet, 5 US, and 1 British.

PRESENTED: October 15, 1960, by A. L. Mints, Academician

SUBMITTED: October 14, 1960

Card 4/4

24660

The Interrelation Between the Results of Measurements Carried out With the Help of Charged Particle Traps on Soviet Cosmic Rockets and Measurements of the Magnetic Field by Means of the American Earth Satellite "Explorer VI" and the Rocket "Pioneer-V"

S/020/60/135/001/012/030
B006/B056

magnetic field. For the purpose of estimating the drift current density and the current at the traps, the authors assume that the geomagnetic field is a pure dipole field, and that the electrons have a Maxwell velocity distribution. They obtained (approximatively)

$$j_{drift} = \frac{6c\Theta NR^2}{B_o R_E^3} \text{ and } j_{trap} = eN\sqrt{\frac{\Theta}{2\pi m}}\, e^{-x},\ x = eV/\Theta;$$

c - velocity of light, Θ - temperature, and N - electron density, R_E - Earth radius, B_o - field on the Earth's surface, B - field at the distance R from the dipole. Thus, $j_{drift}/j_{trap} = 1.55 \cdot 10^{-6}\, e^x/\sqrt{x}$ is obtained. One obtains $\Theta \cong 21$ ev and $N \cong 600$ el/cm^3. Agreement between the Soviet current density measurements and the current densities which may be assumed on the basis of American measurements of the perturbations of the geomagnetic field is quite satisfactory in view of the rough assumptions upon which the

Card 3/4

84660

The Interrelation Between the Results of Measurements Carried out With the Help of Charged Particle Traps on Soviet Cosmic Rockets and Measurements of the Magnetic Field by Means of the American Earth Satellite "Explorer VI" and the Rocket "Pioneer-V"

S/020/60/135/001/012/030
B006/B056

electron flux density attains $\sim 10^8$ electrons/$cm^2 \cdot$sec ($E_e \gtrsim 200$ ev). Herefrom, the conclusion may be drawn that the Earth is surrounded by a belt of charged particles, which is located outside the radiation belt. It is assumed that it is bounded by the lines of force of the geomagnetic field. Soviet space rockets crossed the geomagnetic equator at an altitude of 60,000 km, which is exactly where, according to American measurements, the center of the current belt is located. The maximum of the electron flux density is between about 55,000 and 75,000 km, so that it is about 20,000 km thick, whereas the zone in which an electron flux was found to exist at all, is 40,000 km thick. The authors arrive at the conclusion that in the Soviet trap experiments the total flux density of electrons was measured as amounting to $E_e > 200$ ev, whereas in the American measurements of the geomagnetic field only that component of this flux which is perpendicular to the field lines, was measured. Such a component is the consequence of the known drift of the charged particles in the inhomogeneous

Card 2/4

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

84660

9.6130
3.9100

S/020/60/135/001/012/040
B006/B056

AUTHORS: Gringauz, K. I. and Rytov, S. M.

TITLE: The Interrelation Between the Results of Measurements Carried out With the Help of Charged Particle Traps on Soviet Cosmic Rockets and Measurements of the Magnetic Field by Means of the American Earth Satellite "Explorer VI" and the Rocket "Pioneer-V"

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 135, No. 1, pp. 48-51

TEXT: The authors of the present paper first give a survey of the most essential results obtained with respect to the geomagnetic field and the external radiation belt of the Earth, obtained by means of Soviet space rockets, the "Explorer VI" and the "Pioneer-V" rocket. Using these results it is possible to draw several conclusions with respect to the drift current density and the particle fluxes in great altitudes. By means of the three-electrode charged-particle traps built into the Russian rockets, it was found (1959) that in altitudes of from 55,000 to 75,000 km, the

81401

Measurement of Electron Concentration in the Ionosphere According to the Rotation of the Polarization Plane of Radio Waves Emitted by Rockets

S/020/60/132/06/23/068
B014/B007

three wavelengths as examples. Fig. 2 shows the electron concentration calculated along with the recording of the rotation of the polarization plane of the 48-Mc/s wave from formula (2). The differences between the result obtained here and that of an experiment carried out on February 21, 1958 are discussed. There are 2 figures and 2 Soviet references.

PRESENTED: March 14, 1960, by A. N. Shchukin, Academician

SUBMITTED: March 9, 1960

Card 2/2

81401

S/020/60/132/06/23/068
B014/B007

3.1800

AUTHORS: Gringauz, K. I., Rudakov, V. A.

TITLE: Measurement of Electron Concentration in the Ionosphere According to the Rotation of the Polarization Plane of Radio Waves Emitted by Rockets

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 132, No. 6, pp. 1311 - 1313

TEXT: In the present paper the results of measurements are given, which were obtained by means of a geophysical rocket of the AS USSR on August 27, 1958 reaching an altitude of more than 450 km. The rocket was stabilized in the three directions of rotation. Formula (1) describes the rotation of the polarization plane of the radio wave during its propagation in the terrestrial magnetic field. Formula (2) is developed, which permits determination of the electron concentration in the ionosphere in the case of a vertical, free, completely stabilized flight of the rocket. Details of the antenna construction are discussed; 24, 48, and 144 Mc/s were transmitted. Fig. 1 shows oscillograms of the signal levels of the

IX

Card 1/2

An Ionized Gas and Fast Electrons in the Vicinity of the Earth and in Interplanetary Space

81700
S/020/60/132/05/25/069
B014/B125

the plasma, $n_i \geq 10\ cm^{-3}$ and temperature is not too high ($T \approx 10^4\ {}^oK$). Reference is made to the existence of the plasma of the earth corona, which is found at about R = 15,000 km. Calculated and experimentally determined concentration distributions of the ions as dependent on R are graphically represented in Fig. 3. A steep drop of the ion concentration begins at 15,000 km; this fact requires more exact study. Only an upper limit of $30-60\ cm^{-3}$ can be given for the ion concentration in the range of R greater than 22,000 km. The authors mention among others V. G. Fesenkov (Ref. 10). There are 3 figures and 12 references: 7 Soviet, 3 American, 1 English, and 1 German.

PRESENTED: March 1, 1960, by A. L. Mints, Academician

SUBMITTED: February 24, 1960

Card 3/3

An Ionized Gas and Fast Electrons in the Vicinity of the Earth and in Interplanetary Space

81700
S/020/60/132/05/25/069
B014/B125

Soviet cosmic rockets. Further the estimation of the ion concentration was dealt with according to the data and it was determined that one must know the potential of the receiver in this connection. This potential depends on the fluxes of high-energy electrons ($>$ 200 ev) and the most important information on this was obtained with the help of the measurements of the three-electrode traps. From an extensive investigation it is seen that in the first part of the orbit the flux of electrons with an energy higher than 200 ev does not exceed $2 \cdot 10^7$ cm^{-2}·sec^{-1}. Only electrons with more than 200 ev (flux $1 \cdot 10^8$ - $2 \cdot 10^8$ cm^{-2}sec^{-1}) were found in the third part of the orbit. The existence of a third radiation belt, the lower boundary of which was at 30,000 km on February 2, 1959, follows from the characteristics of the results discussed here. Further, the influence of the photoelectric effect induced by ultraviolet solar radiation on the potential of the receiver is investigated. As calculations show, the potential differs from zero only by several volts when with n_i representing the ion concentration in

Card 2/3

81700
S/020/60/132/05/25/069
B014/B125

3.9000

AUTHORS: Gringauz, K. I., Kurt, V. G., Moroz, V. I., Shklovskiy, I. S.

TITLE: An Ionized Gas and Fast Electrons in the Vicinity of the Earth and in Interplanetary Space

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 132, No. 5, pp. 1062 - 1065

TEXT: As the results of the second Soviet cosmic rocket indicate, the first half of its orbit can be divided into four parts. The first extends to a distance from the earth R = 22,000 km. Significant positive collector currents occur at all traps with negative or zero potentials. In the second part, from 22,000 km to 50,000 km, the collector currents varied between zero and several negative values. In the range from 50,000 km to 70,000 km (third part) negative currents occur in all traps. With R greater than 70,000 km (fourth part) the currents vary in all traps between 0 and $5 - 6 \cdot 10^{-10}$ a. These results agree in all three

Card 1/3

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

80082

The Investigation of the Interplanetary Ionized Gas of High-energy Electrons and the Corpuscular Emission of the Sun by Means of Three-electrode Catchers for Charged Particles in the Second Soviet Cosmic Rocket

S/020/60/131/06/20/071
B014/B007

that there exists a flux of positive ions with more than 15 ev and a density of $2\cdot10^{8}cm^{-2}.sec^{-1}$. In conclusion, the authors draw attention to the proton fluxes with energies higher than 25 ev, which were found to exist by the automatic interplanetary station in October 1959. There are 4 figures and 4 references, 2 of which are Soviet.

ASSOCIATION: Radiotekhnicheskiy institut Akademii nauk SSSR (Radiotechnical Institute of the Academy of Sciences, USSR)

PRESENTED: February 11, 1960, by A. L. Mints, Academician

SUBMITTED: February 5, 1960

Card 3/3

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6

80082

The Investigation of the Interplanetary Ionized Gas of High-energy Electrons and the Corpuscular Emission of the Sun by Means of Three-electrode Catchers for Charged Particles in the Second Soviet Cosmic Rocket

S/020/60/131/06/20/071
B014/B007

respect to the interplanetary medium: There exists a steady gas medium (plasma) of mainly ionized hydrogen with a concentration of $n_i = 5\cdot10^2 + 10^3\ cm^{-3}$ and an electron temperature of $10^4\ {}^oK$; there exist only sporadic corpuscular streams of protons and electrons with velocities of $(1 + 3)\cdot10^8\ cm.sec^{-1}$ and concentrations of $n_i \approx 1 + 10\ cm^{-3}$, in some cases up to $10^3\ cm^{-3}$. It was possible to record positive collector currents of from 10^{-10}a to $50\cdot10^{-10}$a, and negative collector currents of from 10^{-10} a to $15\cdot10^{-10}$ a. Recordings are shown in Figs. 2, 3, and 4. The following conclusions are drawn herefrom: 1) At a distance from the Earth of up to four equatorial semidiameters there exists a plasma with a temperature of not more than several tens of thousands of degrees. Thus, the results obtained by means of the first and third cosmic rocket were confirmed. 2) Within a range of from 55,000 to 75,000 km from the Earth, an electron flux of the density of $10^8\ cm^{-2}.sec^{-1}$ was found to exist, with energies exceeding 200 ev. 3) From the positive collector currents recorded in all four catchers the authors conclude

Card 2/3

3.9000
3.2100

80082
S/020/60/131/06/20/...
B014/B007

AUTHORS: Gringauz, K. I., Bezrukikh, V. V., Ozerov, V. D., Rybchinskiy, R. Ye.

TITLE: The Investigation of the Interplanetary Ionized Gas of High-energy Electrons and the Corpuscular Emission of the Sun by Means of Three-electrode Catchers for Charged Particles in the Second Soviet Cosmic Rocket

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 131, No. 6, pp. 1301 - 1304

TEXT: During the flight of the rocket the currents generated by the charged particles in the catchers were measured and recorded. For this purpose four three-electrode catchers were fitted, each of which consisted of a semispherical nickel net (radius 30 mm), under which a plane nickel collector was fitted. Between these parts a tungsten net was fitted. The potentials on the electrodes are given and the scheme of the catcher is shown in Fig. 1. The task to be performed by the tungsten net was to prevent the photoelectric effect caused by irradiation by the Sun. The electrons, which moved which sufficient energy to overcome the retarding field between the nets, generated a negative collector current. For the purpose of selecting the characteristic of the apparatus, the following was assumed with

Card 1/3

83233

S/033/60/037/004/009/012
E032/E314

Results of Observations Obtained with the Aid of Charged-particle Traps Mounted on Soviet Cosmic Rockets at Altitudes up to 100 000 km

of electrons with relatively low energy (although greater than 200 eV). Further studies of this new radiation belt are said to be urgently required.
There are 11 figures, 1 table and 26 references: 1 German, 10 English and 15 Soviet.

ASSOCIATIONS: Radiotekhnicheskiy institut Akademii nauk SSSR (Radiotechnical Institute of the Ac. Sc. USSR)
Gos. astronomicheskiy in-t im. P.K. Shternberga (State Astronomical Institute imeni P.K. Shternberg)

Card 9/9

83233
S/033/60/037/004/009/012
E032/E314

Results of Observations Obtained with the Aid of Charged-particle Traps Mounted on Soviet Cosmic Rockets at Altitudes up to 100 000 km

are still being examined. The final conclusions are summarised as follows:

1) the Earth is surrounded by a plasma having an ion concentration of $\sim 10^3$ cm^{-3}, which extends to $R \approx 22\ 000$ km. The density of this plasma, which can be looked upon as the ionised component of the "geocorona", decreases regularly with altitude.

2) The concentration of interplanetary ionised gas in the neighbourhood of the Earth is less than 100 cm^{-3} and very probably less than 30 cm^{-3}.

3) In the region of the radiation belt there are few electrons having energies greater than 200 eV. In the region between 55 000 and 75 000 km, the concentration of these electrons reaches a maximum. It follows that the energy spectrum of the electrons in the region of the maximum of the outer radiation belt is much harder than beyond its outer boundary.

4) A new radiation belt has been established. This belt surrounds the Earth and is located between 55 000 and 75 000 km. It consists

Card 8/9

83233

S/035/60/037/004/009/012
E032/E314

Results of Observations Obtained with the Aid of Charged-particle Traps Mounted on Soviet Cosmic Rockets at Altitudes up to 100 000 km

upper boundary of the measured values of the currents in three traps with the outer grid potentials negative and zero. The dotted curve represents the upper boundary of the values of the collector current for the trap with outer grid potential euqal to +15 V. The lower curve is the lower boundary of the measured collector currents in all the traps. In this part of the trajectory (25 000 - 100 000 km) the positive collector currents are practically absent from all the traps while near 60 000 - 70 000 km the collector currents in all the traps are simultaneously negative. Fig. 9 shows the upper boundary of the values of collector currents for traps with negative and zero outer grids, respectively. The crosses refer to $V_{g_2} = -10$ V and the open circles to $V_{g_2} = 0$ V. These were recorded using traps mounted on the first cosmic rocket. Fig. 10 shows the currents for the "25 V" and the "-10 V" traps recorded at altitudes up to 8 000 km. The "25 V" results are represented by the triangles and the "-10 V" results by the points. These results

Card 7/9

83233
S/033/60/037/004/009/012
E032/E314

Results of Observations Obtained with the Aid of Charged-particle Traps Mounted on Soviet Cosmic Rockets at Altitudes up to 100 000 km

experimental results can be shown in the form of curves connecting the maximum and minimum values of the collector currents. In Fig. 7, Curves 1, 2, 3 and 4 are the upper limits of the recorded values of collector currents with the potential of the outer grids relative to the container equal to -10, -5, 0 and +15 V, respectively. Curve 5 is the lower boundary of the collector currents for thre traps, in which the potential of the outer grid relative to the body of the container was negative or zero. These curves show the considerable dependence of the current due to positive particles reaching the collector on the potential of the outer grid. At altitudes exceeding 3 000 km the positive potential of the outer grid retards the positive ions almost entirely and prevents them from reaching the collector. The lack of similarity between Curves 1, 2 and 3 can be ascribed to changes in the orientation of the traps relative to the velocity vector and the direction of the Sun. Fig. 8 shows the data obtained with the second cosmic rocket. The upper continuous curve shows the

Card 6/9

83233
S/035/60/037/004/009/012
E032/E314

Results of Observations Obtained with the Aid of Charged-particle Traps Mounted on Soviet Cosmic Rockets at Altitudes up to 100 000 km

g_2 and g_1 (200 V). However, energetic electrons belonging to the radiation belts cannot be stopped by the g_1 grid and electrons with energies greater than 200 eV give rise to negative collector currents. Measurements obtained with these traps were corrected for the effect of the potential of the container and its motion. Fig. 6 shows the currents measured on September 12 1959 at altitudes up to 25 000 km, using traps with $V_{g_2} = 0$ and +15 V. The translational motion of the container is accompanied by the simultaneous rotational motion and hence the orientation of each trap relative to the velocity of the container and the direction of the Sun varies continuously. The maximum and minimum values of the collector current correspond to certain definite orientations of the container. In order to exclude the effect associated with the rotation of the container, the

Card 5/9

83233

S/033/60/037/004/009/012
E032/E314

Results of Observations Obtained with the Aid of Charged-particle Traps Mounted on Soviet Cosmic Rockets at Altitudes up to 100 000 km

was reduced by an order of magnitude compared with the traps mounted on the first rocket. Most of the aluminium surface of the container was covered by an Al_2O_3 coating (or film). If the potential on g_2 is less than kT/e then the positive ions due to the stationary interplanetary gas penetrate into the space bounded by g_2, are accelerated in the field between g_1 and g_2 and, on passing through g_2, enter the collector. Thus "0 volt", "-5 volt" and "-10 volt" traps should record ions due to the stationary plasma which would be larger for lower values of the potential on g_2. If the latter is very much greater than kT/e, then the ions will not pass through g_2 and the +15 V trap will not record ions due to the stationary gas with a temperature of, say, 10 000 $^{\circ}$K. The electrons due to the ionised gas do not enter the collector since they are ejected by the field between

Card 4/9

IX

83233
S/033/60/037/004/009/012
E032/E314

Results of Observations Obtained with the Aid of Charged-particle Traps Mounted on Soviet Cosmic Rockets at Altitudes up to 100 000 km

magnitude. Current amplifiers were provided and positive currents between 10^{-10} and 5×10^{-9} and negative currents between 10^{-10} and 2×10^{-9} A could be measured. In the case of the second cosmic rocket the potentials of the outer grids (g_2) were -10, -5, 0 and 15 V, respectively. The collectors and the inner (anti-photoelectric) grids were plane. The traps were located at the corners of a tetrahedron inscribed into a sphere. In these traps the photoelectrons due to solar radiation and emitted from the outer grid do not reach the collector and the collector photo-current is completely suppressed by the electric field between the collector and the inner grid. Photoelectrons from the latter are partly ejected from the trap or strike the outer grid and are partly intercepted by the collector giving rise to a negative current in the collector circuit. In this way, the negative current in the collector circuit due to the illumination of the inner grid

Card 3/9

83233
S/033/60/037/004/009/012
E032/E314

Results of Observations Obtained with the Aid of Charged-particle Traps Mounted on Soviet Cosmic Rockets at Altitudes up to 100 000 km

were as follows: collector 90 V; intermediate grid g_1 - 200 V; the outer grid g_2 + 10 V and 0 V in the case of two of the four traps. The potential of the outer grids of the other two traps was +15 V and their collectors were connected together. The general arrangement of electrodes in these three-electrode ion traps is indicated in Fig. 1. The first grid (g_1) served to suppress the photocurrent from the collector produced under the action of the solar radiation and other radiations incident on the collector. This grid also suppresses secondary electrons emitted by the collector. All the traps were located in the meridional plane of the container. Different potentials were given to the outer grids in order to estimate the energy of the positive particles entering the traps and, in particular, to distinguish between currents due to stationary gas particles (energies of the order of 1 eV) and currents due to protons in the corpuscular streams, whose energies are higher by two or three orders of

Card 2/9

APPROVED FOR RELEASE: 06/23/11: CIA-RDP86-00513R000616900035-6